

A Hybrid Approach To Build Automatic Team Composition In League of Legends

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ABSTRACT

League of Legends is one of the most played games available in the market. The game had over 1.2 billion play hours from June 2011 thru July 2012, almost the double of the second place. We can associate the success of this game with the growing eSports Market. In 2017, during the Mid-Season Invitational event, a Riot Games event held in Brazil, over 364 million viewers watched the tournament. To reach success in this sport category, strategy and a good knowledge of the game is very important. Also, it is expected that the team mates and the coach define a good strategy while picking the characters, also called champions, which the team is going to play with. Our goal in this paper is to model a expert system to help the players decide which champion should be picked assuming that the champion is updated in the metagame and has a good synergy with the other champions. For that, the MinMax algorithm was used to model and create all possibilities of choosing champions, and also a classification algorithm to evaluate each option and give them a grade to optimize the MinMax algorithm through alpha-beta pruning. The proposed modelling showed itself promising. Its application on eSports may result in the development of team compositions never thought before in which may be very beneficial to the players.

Keywords: League of Legends, Team Composition, eSports.

1 INTRODUCTION

League of Legends, also called LoL or League, is a recognized game from the MOBA (*Multiplayer Online Battle Arena*) genre. With a large amount of players around the world, it has increased its number of players over the last years. In 2012, the magazine Forbes [4], with data from DFC Intelligence and Xfire, titled the game as the most played game, with almost the double number of hours played than the second place.

With many different game maps, League of Legends is always providing different ways to keep the players entertained. There are three fixed game maps, Summoner's Rift, Howling Abyss and Twisted Treeline. Besides that, Riot Games, League of Legends' developer, provides a rotative game mode in which a custom map become available to the players.

The most played game map, also used for ranked games and tournaments, Summoner's Rift became the most popular map between the players. In this map, two teams with 5 players each, fight with each other in order to destroy the other team Nexus, the primary goal of the game.

Summoner's Rift is a squared map in which two bases is positioned diagonally and in opposite sides. The space in between them is composed by three lanes, known as Top Lanes, Mid Lane and

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Bottom Lane. The Top and the Bottom Lane tangentiate the map border, while the Middle Lane pass a diagonal line in between the bases. Also, between the lanes are fulfilled with a jungle with Neutral Monsters with special effects. Figure 1 contain a sketch of the map.

The goal of the game is to destroy the enemy's Nexus, a magical structure located in the center of the base. This Nexus is protected by three Inhibitors and eleven Turrets in which there are three Turrets on each lane and two closer to the Nexus. The Inhibitors avoid the other team to create *Super Minions*. Minions are small units spawned periodically by the Nexus to advance toward the enemy's base. They attack the enemy's Minions, Turrets, Inhibitors and Champions on their way.

With the growth of League of Legends and its application on the digital market, many eSports team started to invest in its competitive scenario. eSports can be understood as a type o sports in which is mediated by computer or video games [5]. Also, eSports is used to designate a competition, with teams managed and maintained by institutions, regional or worldwide.



Figure 1: Summoner's Rift Map by Riot Games

In 2003, it was held the first electronic sport championship with over 150 thousand players all around the world. In 2004, the second event counted over a higher number, with almost 250 thousand participants [7]. Since then, this numbers grew up exorbitantly. In 2017, Brazil hosted the MSI Event (Mid-Season Invitational), one of the biggest championship of League of Legends, with over 365 million viewers [2].

In competitive games, every detail is important. In order to win the match, some strategies are prepared before the game in order to decrease the enemy's chance to win. With infinite possibilities to combine characters, some compositions offer vantages over the others, and manage the task to pick champions, or characters, is



Figure 2: Mid-Season Invitational 2017 held in Brazil. Photo by Riot Games Brazil.

quite hard even for professional players and the team coach.

Before the match, in the champion selection area, there are two different ways to pick the player’s character, they are: blind mode and alternate mode. The blind pick is composed by every team pick their character without knowing the other team choices. In this mode, they only see the other team champion during the loading phase, being totally blind the other’s team character.

In the alternate mode, the players pick their champions in a range of 1:2:2:2:2:1, in which the first player pick one champion and then, the players of each team pick two following the order of 2 by 2. This selection mode is used for competitions and ranked games.

The teams on competitive tournaments are usually composed by professional players in which, over the years, get experience, knowing the champions mechanics and their game style. In games, which require this level of experience, strategic planning involved the selection of champions is important to the point which they can implicitly define the outcome of a match before it event starts [1].

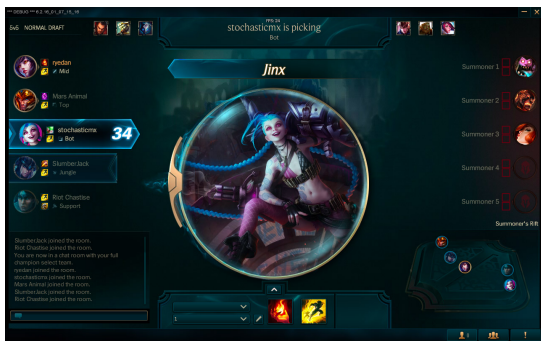


Figure 3: Champion Selection Screen in Draft Mode. In this selection mode, each player select its champion in order of 1:2:2:2:2:1. This selection mode is also used in ranked and competitive games. Source: YouTube

Choosing a team well can be the key to win the match. For this, we propose a hybrid methodology based on the MinMax algorithm, which is widely used in games in a context where there is a dispute between the sides, with Linear Regression. MinMax in this context can generate several trees with possible good teams, thus requiring a new method to create gradual classification between teams. With linear regression, we can evaluate this classification, thus identifying the team with the highest chance of victory. This work proposes a computational modeling of an expert system, which automatically suggests to the player a team composition that seeks to decrease the opponent’s gains and maximize the advantage of his team.

2 RELATED PAPERS

While searching for the state of the art, we noticed that there is a lack of works for League of Legends. Since there is a lot of available data for Dota 2, several studies have been conducted in order to improve the game experience. In this section, we will review some works conducted to solve the same problem as proposed in the present paper.

In the work of Conley et al.[3], it was developed a tool to assist player picking characters in Dota 2, a similar to League of Legends game with the same genre MOBA. In his proposal, it has been developed an algorithm to first represent the match into a feature vector, then create another set of features vectors with different characters to finally calculate the probability the team has to win. The algorithm used for this purpose was Logistic Regression and K-Nearest Neighbor. Similar to his work, our approach for League of Legends is to model the possibilities in picking characters in competitive games and also considering a real-time application, in which the recommendation changes while other champions are picked.

Dota2 offers a possibility to download the game replay after the match ends. This feature allows websites such as DatDOTA to produce a large amount of data about tournaments. This data can be later used to train machine learning algorithm and be used for data mining. In the work of Summerville at al. [6], it was used this dataset to develop a methodology in which using Long Short-Term Memory Artificial Neural Network (LSTM-RNN) and Bayes Nets, the data are analyzed letting them able to predict which champion are going to be picked.

3 FUNDAMENTALS

Machine Learning applied to optimization process in eSports is a powerful tool to better understand the game features and develop new strategies. As an example of its application, we can detect pattern in building victorious team and also develop a expert tool to build automatic teams. As the researchers start to apply artificial intelligence in eSports, we might see strategies and team compositions never seen before, opening opportunities for a more competitive tournament with unique strategies.

3.1 MinMax Algorithm with Alpha-Beta Pruning

The MinMax, also known as Minimax or MM, is an algorithm based in decision rules for minimize the loss in the worst case (maximum loss). It can also be used to maximize the gain, in this case the algorithm turns into a MaxMin type.

This algorithm is largely used in AI bots in electronic games. Its main application is turn-based games such as checkers, chess and tic-tac-toe. In these games, the MinMax algorithm model all possible movement the players might have and suggest the best one in which the loss is lower.

3.2 Linear Regression for Team Composition Evaluation

Linear regression is a mathematical approach which model the relationship between the variables. It can be used on data analysis to generate a linear predictor function which describe the data of a dataset. Later on, this function can be used to classify new entries and so on work as a classifier algorithm.

4 PROPOSED MODELLING

Some steps are required in order to develop the recommendation system. First we developed the MinMax tree in order to model all the champion selection possibilities. Then, we evaluate every team with a linear regression function in order to give them a grade, such as a victory rate. And in the last step, we used the MinMax’s Alpha-Beta Pruning algorithm in order to optimize the champion recommendation and minimize the loss. This scheme are represented in

the Figure 4 and in the next paragraphs we will describe better each of these steps.

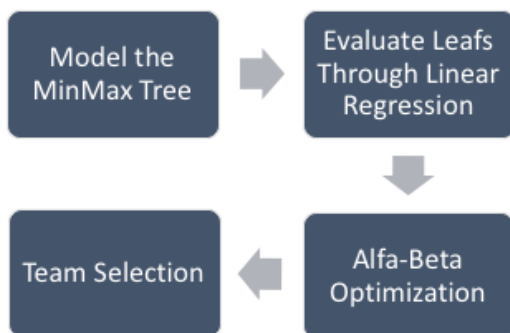


Figure 4: The methodology operation flowchart.

For the task of modelling the player’s choices simplify the understanding, we consider a few restrictions. It is common for competitive players to choose from a small pool of champions. These champions are listed in the metagame, a list with the most played and strongest characters available in the current patch (or game version). Thus, we consider picking champions in the metagame, but it doesn’t mean that the system is limited to it.

Another restriction considered in our proposal was the draft mode selection. In this selection, every team pick their champion in an alternate mode in which the first and the last player pick only one champion and the others pick two in the following order *team1/team2/team1/team2/team1/team2*, picking 1 : 2 : 2 : 2 : 1 champion at a time. This restriction is important because this is the selection mode used in competitive and ranked games.

The proposed modelling is based in use MinMax algorithm in order to model all champion selection possibilities. Every leaf of the MinMax tree represents the last champion picked, and the path between the first pick and the last one, the leaf, represents the two teams. A simple representation of this model is shown in the Figure 5.

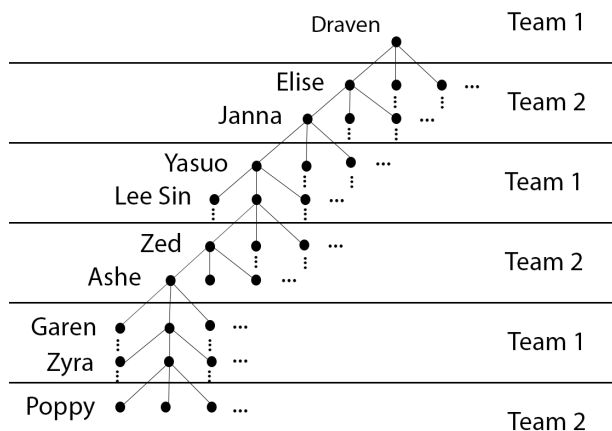


Figure 5: Modelling teams example. From the root to the leaf, the Team 1 is composed by Draven, Yasuo, Lee Sin, Garen and Zyra while the Team 2 is composed by Elise, Janna, Zed, Ashe and Poppy.

To evaluate each path, it has been develop a dataset with all the information available from the last edition of CBLoL – *Campeonato Brasileiro de League of Legends*, the Brazilian League of

Legends Championship. This dataset contains information about every champion picked for each game role and also the result of the match, such as victory or defeat.

Table 1: Part of the CBLoL 2017 Dataset.

Top	Mid	Jungle	ADC	Support	Result
Sion	Syndra	Lee Sin	Ashe	Zyra	Loss
Poppy	Ekko	Rek’Sai	Ezreal	Karma	Win
Rumble	Cassiopeia	Khazix	Varus	Zyra	Loss
Illaoi	Cassiopeia	Lee Sin	Ashe	Zyra	Win
Maokai	Jayce	Elise	Ziggs	Karma	Loss

This dataset was used to train a Linear Regression model. This model provided us a function which better described the data. Our goal with this function is to use it as an equation in order to classify and give the leaf of the MinMax tree a grade for the alpha-beta pruning step. This grade represents the chance every suggested team has to win the match. To perform the Linear Regression algorithm, it was used the Weka 3.8.1 software.

After evaluating every team and obtain its grades, the alpha-beta pruning optimizes the MinMax tree. This optimization let the best option in which the loss is lower, in term of grade, the chance of losing the game is lower, giving the best team suggestion in a fast and less expensive environment.

5 DISCUSSION AND APPLICATIONS

Create better teams is not only good for competitive games, there are several other applications which makes it a good research topic. For example, it is possible to apply the proposed model to teach MinMax Algorithm with Alpha-Beta Pruning to an Artificial Intelligence class. In this section, it will be explained some of these applications including the eSports Market.

5.1 e-Sports Market

Choosing the correct champion might be the key to the victory. eSports is a competitive environment in which the better strategy may lead the team to the success. This task is not always as simples as we imagine. There are several restrictions we may consider, some of them are the metagame, the ability the player has with the champion and the other team’s champion.

Team coach is the professional which is in charge of help the team picking their characters. This tool would help not only players who plays ranked games but also coaches who has the hard task to pick champions on a championship.

5.2 Educational Purpose

Teachers are always trying to develop recreational activities to engage the students in the content taught. Some of these activities introduce games and other entertainment technologies into the classroom. The playfulness and the ability to attract the student attention is a must for this kind of teaching methodology.

Including games in the classroom is a practice that have been seen in some schools now-a-day. League of Legends is a good source of situation-problem for AI classes. Since the professor has some knowledge with the game, it is easy to approach situations to apply some machine learning algorithm, such as K-Nearest Neighbor (KNN), Genetic Algorithm and Artificial Neural Network.

6 CONCLUSION

Earlier we saw how important is the correlation between the characters of the same team and how much this can influence in a game of League of Legends. We can infer that software with the characteristics presented in the modeling can be very proficient, both for professional players, as for amateurs and casual.

For future work, it is expected to develop a tool that brings applicability of the proposed modeling to professional players in the field of electronic sports. Also, it is possible to improve the proposed modelling using more robust algorithm, also including new restrictions to the problem. This tool can be made available to players or even for future research in the area.

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